Kefeng Jiang
Graduate Student Research Presentation

Observation and Characterization of Stochastic Resonance in Directed Propagation of Cold Atoms

We report on the observation and first experimental characterization of stochastic resonance in a modulated optical lattice, i.e., a resonant enhancement in the conversion of random atomic recoils from spontaneous emission into directed motion. We study the dependence of stochastic resonance on modulation depth and lattice well depth.

Pawan Khatiwada & Zibo Wang
Graduate Student Research Presentation

Coherent Perfect Absorption in Cavity Quantum Electrodynamics

Coherent Perfect Absorption or CPA in short, is an interference phenomenon in which the light fields incident on a lossy medium are neither reflected nor transmitted but completely absorbed by the medium through the process of destructive interference among all scattering amplitudes. This material-independent phenomenon was put forward in 2010 for the first time by the Douglas Stone group at Yale [1] where they called CPA as time-reversed laser or anti-laser due to its ability to completely absorb the coherent fields by cleverly adjusting the phase and the intensity of the light beams. In their celebrated findings, Stone et al. theoretically predicted 99.9% light absorption at discrete frequencies by a Si slab in the 500nm-900 nm wavelength regime. Within a year, in 2011 the first experimental demonstration of the CPA was reported with ~ 99.4% of absorption using infrared light beams [2]. Since then the CPA has shown applications in photodetection instruments, solar cells, microwave & radio wave antennas, interferometers, etc. [3].

At the quantum scale, CPA can be useful for information processing, in particular, for the storage of quantum information which is the key requirement in long-distance quantum communication and quantum networking protocols. In this talk, we will discuss how the CPA can be realized in cavity quantum electrodynamics. Our system will consist of two laser beams shined on the mirrors of a bidirectional single-mode optical cavity interacting with a single-two level atom trapped inside. By driving the equations of motion for the quantum mechanical operators involved, we'll find the transmission and reflection intensities which will indicate the right conditions for the existence of CPA. Particular attention will be paid to the requirement of using two laser fields versus a single laser under the realistic conditions of photon loss from the cavity mirrors and spontaneous emission from the two-level atom.

[1] Y. D. Chong, L. Ge, H. Cao, A. D. Stone, "Coherent perfect absorbers: Time-reversed lasers" Phys. Rev. Lett,.105, 053901 (2010).

[2] W. Wan, Y. Chong, L. Ge, H. Noh, A. D. Stone, H. Cao, "Time-reversed lasing and interferometric control of absorption" Science 331, 889–892 (2011)

[3] D. G. Baranov, A. Krasnok, T. Shegai, A. Alu`, and Y. Chong, "Coherent perfect absorbers: linear control of light with light", Nature Reviews Materials, vol. 2, no. 12, pp. 1–14, (2017).

Wednesday
September 9, 2020
4:25 – 5:30pm

Scan code to connect

MIAMI UNIVERSITY